

**New species and lectotypifications of some reticulate-nerved *Tephrosia*
(Fabaceae) from north-west Australia and the genus
Paratephrosia re-evaluated**

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Abstract

Cowie, I.D. New species and lectotypifications of some reticulate-nerved *Tephrosia* Pers. (Fabaceae) from north-west Australia and the genus *Paratephrosia* re-evaluated. *Nuytsia* 15 (2)163–186 (2004). Eight new species of reticulate-nerved *Tephrosia* are described from the Kimberley Region of Western Australia and the Northern Territory (*T. andrewii* Cowie, *Tephrosia bifacialis* Cowie, *T. carriemichelliae* Cowie, *T. ephippioides* Cowie, *T. gyropoda* Cowie, *T. humifusa* Cowie, *T. procera* Cowie, and *T. valleculata* Cowie). *Paratephrosia* is reduced to synonymy under *Tephrosia* and a new name, *Tephrosia lasiochlaena* Cowie, is published for *P. lanata*. Lectotypifications are provided for six reticulate-nerved and allied taxa of *Tephrosia* (*T. flammea* F. Muell. ex Benth., *T. nematophylla* F. Muell., *T. oblonga* R. Br. ex Benth., *T. polyzyga* F. Muell. ex Benth., *T. porrecta* R. Br. ex Benth. and *T. reticulata* R. Br. ex Benth.).

Introduction

Tephrosia Pers., is a pantropical genus of more than 400 species of herbs and shrubs (Geesink, 1981). In Australia, the genus occurs predominantly in the tropics and subtropics, generally growing in well-drained sites in open habitats. The most recent comprehensive treatment of the genus in Australia is that of Bentham (1864), who recognised 23 species. Since then additional species have been described by Mueller (1875, 1879, 1880, 1883), Domin (1912, 1926), Fitzgerald (1918) and more recently Pedley (1977), among others. Bosman & de Haas (1983) revised the genus for Malesia, with several species from that area also occurring in northern Australia. It is known that the genus contains a number of complexes requiring further investigation as well as many undescribed taxa. The present paper has been prepared to allow fuller descriptions of species and discussion of decisions prior to treatment in the Flora of Australia.

The genus is united by a suite of characters, many of which could be considered conservative. These include: the presence of only simple basifixed hairs; usually a lack of stipellae and bracteoles; flowers with bee pollination syndrome; a standard which is sericeous or pubescent on the outer surface and which lacks inflexed auricles; uniform anthers; and a simple, dehiscent pod with thinly coriaceous valves (Hutchinson, 1964; Geesink, 1984). As currently circumscribed, *Tephrosia* includes informal groups possibly endemic to Australia that are defined by leaf venation. In Australia, four basic venation types, with variations, can be distinguished in cleared leaves:

(i) species with parallel secondary veins extending to the margin, the intersecondary venation closely spaced and parallel to the secondaries but breaking up into a sparse, indistinct reticulum before reaching the margin (e.g. *T. phaeosperma* F. Muell. ex Benth.) grading into;

(ii) species with well spaced secondary veins extending to the margin, the intersecondary veins short to obscure and breaking up into a sparse, indistinct reticulum (e.g. *T. virens* Pedley). (Many orange flowered species in this group develop fine, short parallel striae on the cuticle of the leaflet undersurface on drying, although the cause of this has yet to be investigated.);

(iii) species with numerous closely spaced parallel secondary veins which dichotomise and anastomose submarginally, the intersecondary veins subparallel to secondaries and breaking up into a sparse, indistinct reticulum well before the margin (e.g. *T. macrocarpa* Benth.); and

(iv) species with well spaced secondary veins curving or dichotomising before the margin, the intersecondary venation often closely reticulate, prominent or not.

In addition, a number of yellow or orange flowered species with small or very narrow leaflets are difficult to place clearly in any of these groups (e.g. *T. arnhemica* White, *T. nematophylla* F. Muell., *T. simplicifolia* F. Muell ex Benth.). Whilst type (i) venation is apparently common in *Tephrosia* and some related genera in other parts of the world, the extent of occurrence of other venation types is not clear (Hutchinson, 1964; Gillett *et al.*, 1971; Bosman & de Haas, 1983; Geesink, 1984). The species described here belong to the fourth group, having reticulate intersecondary venation and usually orange flowers.

Flowers in the genus may be in pseudoracemes or only in axillary fascicles, with both inflorescence types occurring across the venation types. Corolla colour is in two basic groups corresponding partly with venation type and is either of the "purple" type including those from almost white through mauve and pink to dark red (corresponding to type (i) and type (ii) venation) or yellow to orange (corresponding to type (ii), (iii) and (iv) venation). The Australian orange and yellow flowered species usually have loose spongy or membranous tissue between the seeds (although not truly septate) and most have flattened, glabrous styles and penicillate stigmas. Pods are of two common types: (a) straight in the lower half and straight to slightly upcurved towards the apex, the beak in line with the upper margin, or (b) straight with a more or less central beak. In Australia, these pod types are found in all venation and flower colour types. Clearly, there is a need for further investigation of generic limits and infrageneric subdivisions.

Methods

This study was based primarily on the gross morphology of dried herbarium material supplemented by field observation of most species. Descriptions of flowers have been prepared primarily from rehydrated material and material preserved in Kew mixture, while other parts have been measured and described using dried material. A DELTA (Dallwitz 1980; Dallwitz *et al.* 1999) database of 112 characters was compiled and used to generate descriptions of each species. Photographs of type material located at K and BM were consulted, while types at BRI, MEL and DNA were either obtained on loan or consulted at those institutions. Definition of terms generally follows Stearn (1966). Distribution maps were prepared using ARCVIEW GIS 3.2 from locality data on herbarium specimen labels.

Taxonomy

Paratephrosia

Paratephrosia lanata (Benth.) Domin was originally described by Bentham (1864) in the genus *Lespedeza*, perhaps because of the woolly-tomentose indumentum, one-seeded pod, axillary flowers, 3-foliolate leaves with reticulate venation, and lack of hooked hairs. At the same time Bentham (1864) apparently overlooked the sericeous back and lack of inflexed auricles on the standard, the flattened style and the vexillary stamen which is free at the base and connate above, characters consistent with *Tephrosia* rather than *Lespedeza*. Domin (1912) transferred the species to a new monotypic genus, *Paratephrosia* Domin which he described as distinct from *Tephrosia* because of the dense indumentum, crowded, pinnately 3-foliolate leaves, reticulate venation, relatively long linear-subulate stipules and bracts, and flowers in axillary fascicles. Domin noted that while *Paratephrosia* agreed with the African genus *Requienia* in the uniovulate ovary it differed by the 3-foliolate leaves, strongly elongated calyx lobes and short calyx tube, but did not mention the reticulate leaflet venation in this instance. Geesink (1984) tentatively reduced *Paratephrosia* to synonymy under *Tephrosia*, pending a more detailed study of the Australian species and noting that the characters used to discriminate *Paratephrosia* are not rare in *Tephrosia*. Likewise, I argue here that *Paratephrosia* be reduced to synonymy under *Tephrosia*.

Almost all of the characters used by Domin (*loc. id.*) to segregate *Paratephrosia* are now known to be found in other species included in the genus *Tephrosia* as it is recognised in Australia (see below). Although the crowded fascicle-bearing leaves are unique to *Paratephrosia* and can give it a distinctive appearance, this is only through the reduction of the internodes and not through any basic structural difference. The stipules and bracts which Domin described as linear-subulate (apparently based only on the type) are quite variable in size and shape in this widespread species, ranging from 3–15 mm long and overlap with those of many other species. As discussed further below, reticulate venation is present in some 12 Australian species of *Tephrosia* previously named; trifoliolate leaves are commonly present in at least 16 species; 11 species can have flowers primarily in axillary fascicles and four species are predominantly uniovulate. Trifoliolate leaves, flowers in axillary fascicles and a uniovulate ovary all occur not just in reticulate-nerved species but also in some species with purple flowers and type (i) venation (e.g. *T. brachycarpa* F. Muell. ex Benth., *T. stuartii* Benth. and *T. leptoclada* Benth.).

Considering the situation more closely, there is a group of seven species appearing closest to *P. lanata*. This *Paratephrosia* group all have a similar dense, white to more or less ferruginous, woolly indumentum, usually pinnately 1 or 3-foliolate leaves, broad leaflets, prominent reticulate venation, orange flowers in axillary fascicles and vexillary calyx lobes usually divided to the same depth as the lower three. Within this group, 4 species (*T. arenicola* Maconochie, *T. forrestiana* F. Muell., *Paratephrosia lanata* and *T. uniovulata* F. Muell.) are more closely united by the presence of usually one-seeded pods, although leaves may be only 1-foliolate, 1-foliolate and pinnately 3-foliolate or only pinnately 3-foliolate. *Paratephrosia* differs from these species primarily by the crowded fascicle-bearing leaves. The other three species, *Tephrosia andrewii*, Cowie *T. valleculata* Cowie and *T. carriemichelliae* share the indumentum, axillary flowers, leaves and reticulate venation of the *Paratephrosia* group but are 3–7-ovulate and have differing pods. In addition, *T. carriemichelliae* differs in having the vexillary calyx lobes partly connate above the calyx tube (as is the usual case in *Tephrosia*) and has 1-foliolate or apparently simple leaves whilst *T. andrewii* and *T. valleculata* are sometimes pinnately 5-foliolate. Also, *T. carriemichelliae* and *T. andrewii* both have terete styles while the style of *T. carriemichelliae* is also bearded - characters known from the genus in other parts of the world (Brummitt, 1980; Bosman & de Haas, 1983). Given the overlap of characters within this group, it does not seem feasible to maintain *Paratephrosia lanata* as distinct from it at generic level.

Enlarging the circumscription of *Paratephrosia* to include this *Paratephrosia* group can be considered. However, none of the characters of this group except the density of the indumentum is unique to it and there is a gradual transition to the remainder of *Tephrosia*. A large group of species has reticulate intersecondary venation, broad leaflets, almost always yellow or orange flowers and partly connate upper calyx lobes. For most of these species leaflet venation and subulate stipules are the only two of Domin's characters in common with *Paratephrosia sensu stricto*. Amongst these, the closest species to the *Paratephrosia* group is perhaps *T. coriacea* Benth., a species that is 1-foliolate or less often 3-foliolate, has broad leaflets with reticulate intersecondary venation, flowers in axillary fascicles, 4–7 ovules, but lacks the indumentum of the *Paratephrosia* group. A closely related undescribed taxon (known from a single fruiting collection) appears to differ from *T. coriacea* primarily by having a racemose inflorescence. Many species with racemose inflorescences have a few fascicles in the upper leaf axils whilst in *T. porrecta* R. Br. ex Benth., the fasciculate, axillary inflorescences grade into a pseudoraceme as the fascicle-bearing leaves diminish in leaflet number towards the branchlet apex. *Tephrosia lamproloboides* F. Muell., *T. humifusa* Cowie, and *T. bifacialis* Cowie are apparently close to *T. coriacea* and are 1–3-foliolate, have broad leaflets, and 4–12 ovules but have racemose inflorescences. The closest species to *T. bifacialis* and *T. lamproloboides* appear to be *T. varians* (Bailey) C. White (5-foliolate with 6–12 ovules) and *T. reticulata* R. Br. ex Benth. (with 7–11-foliolate leaves and 5–9 ovules). From here, there are a whole suite of species with an often sparse indumentum, many leaflets, reticulate venation, racemose inflorescences, orange flowers, partly connate upper calyx lobes, and more than 4 ovules. Among these *T. conspicua* W. Fitzg., *T. oblongata* R. Br. ex Benth. and *T. procera* Cowie, have broad leaflets while there are others with much smaller or narrower leaflets (e.g. *T. crocea* R. Br. ex Benth., *T. ephippioides* Cowie, *T. polyzyga* F. Muell. ex Benth., *T. porrecta* R. Br. ex Benth.).

At the time Domin described *Paratephrosia*, fewer species of *Tephrosia* were described and the genus may have seemed clearly distinct. However, in the intervening years more species have become known, with several closely related species described here. It can be seen that *Paratephrosia* fits into the continuum of characters in *Tephrosia* and on this basis *Paratephrosia* should be reduced to synonymy. A new name is needed for *Paratephrosia lanata* when placed in synonymy of *Tephrosia* since the epithet *lanata* is already occupied in the genus.

Tephrosia lasiochlaena* I.D. Cowie, *nom. nov.

Based on *Paratephrosia lanata* (Benth.) Domin *Repertorium Specierum Novarum Regni Vegetabilis* 11: 262 (1912). - *Lespedeza lanata* Benth. *Fl. Austral.* 2: 241 (1864), non *Tephrosia lanata* Mart. & Gal., *Bull. Acad. Roy. Soc. Bruxelles* x.II. 48. (1843). *Typus*: Mt Strzeleckie, [N.T.], J.McD. Stuart (*holo*: K, photo seen; *iso*: MEL!).

Etymology. The specific epithet is from the Greek, *lasios* - woolly and *chlaena* - a cloak or covering and refers to the thick woolly indumentum on the foliage, branchlets and calyx of the species.

Tephrosia andrewii* I.D. Cowie, *sp. nov.

Tephrosia uniovulatae affinis, a qua ovulis quatuor vel quinque; floribus distincte grandioribus, foliolo terminale comparate brevior, leguminibus longioribus et seminibus pluribus differt.

Typus: Great Northern Highway area, SSW of Broome [precise locality withheld], W.A., 6 Apr. 1993, A.A. Mitchell 3024 (*holo*: PERTH!; *iso*: CANB!, DNA!).

Shrub, ascending, multistemmed, perennial, to 0.8 m, rootstock not seen. Branchlets, leaf and inflorescence rachis densely hairy, hairs ascending and patent, white. *Leaves* simple to imparipinnate; stipules persistent, antrorse, subulate, 2–4 mm long, silvery to red brown; petiole or rachis 0–22 mm long to basal leaflets, 13 mm between leaflets, 3–12 mm to terminal leaflet, 0–37 mm long overall; stipellae absent; *leaflets* 1–5; discolourous; obovate to broadly cuneate, sometimes rhomboidal or suborbicular, flat, 15–31 mm long, 12–29 mm wide, 1–1.3 times as long as wide, larger towards apex; secondary veins in 6–7 pairs, intersecondary veins reticulate, upper surface moderately hairy, hairs ascending, hyaline, lower surface with raised veins, densely hairy, hairs ascending, white; base attenuate or cuneate, apex obtuse to occasionally retuse, mucro usually absent; terminal leaflet 1.1–1.2 times as long as laterals. *Inflorescence* fasciculate, axillary, to 15 mm long, fascicles well spaced, 2-flowered. *Bracts* caducous, antrorse, subulate, c. 3 mm long; pedicels c. 2 mm long; bracteoles present on pedicels. *Calyx* 9–11 mm long, densely hairy, hairs ascending, white; tube 2–3 mm long, shorter than lobes; lobes long attenuate, all more or less equal; vexillary lobes divided equally to lower three, free for c. 7 mm; lowest lobe 7–8 mm long. *Corolla* orange, standard 11–13 mm long, claw c. 2.5 mm long, blade subquadrate to almost transversely elliptic, slightly callused at base, apex rounded to retuse; wings c. 12 mm long, longer than keel, blade oblong; keel 10–11 mm long, glabrous. *Staminal tube* glabrous near fenestrae, fenestrae callused on margins; upper filament straight in lower half, thickening gradually towards base, glabrous. *Ovules* 4–5. *Style* terete, tapering, glabrous; stigma penicillate at base. *Fruit* a pod, narrowly oblong, straight, raised over seeds, 27–41 mm long, 6.5–7 mm wide, with loose, spongy tissue between seeds, white, densely hairy, hairs ascending, white; beak central, deflexed. *Seeds* 1–5 per pod, c. 7 mm between centres, smooth, whole coloured, pale brown, oblong to lenticular, c. 4.6 mm long; hilum central; aril absent. Fig. 1 (A–H).

Other Specimens Examined. WESTERN AUSTRALIA: between de Grey River and Lagrange Bay, 1879, A. Forrest & J. Charey s.n. (MEL); Thangoo Station, on Pt Headland road [precise locality withheld], 13 Oct. 1984, P. Foulkes 49 (PERTH); Great Northern Highway, SSW of Broome [precise locality withheld], 17 Aug. 1993, A.A. Mitchell 3269 (DNA, PERTH).

Distribution. Endemic to an area between Broome and Port Headland, W.A. Fig. 2C.

Habitat. Grows in pindan country, in shrubland on sandy soils.

Flowering and fruiting. Flowers Apr. & Oct.; fruits Apr. & Aug.

Conservation status. Conservation Code for Western Australian Flora: Priority One. This species is known from only a few collections and is not known to occur on any reserve. The size and extent of populations and existence of any threats to the species is not known and requires further investigation.

Etymology. This species is named in honour of Andrew A. Mitchell, botanist with the Australian Quarantine and Inspection Service, a diligent collector of *Tephrosia*, who also collected the type specimen.

Affinities. Most closely related to *T. uniovulata*, but differs in the ovary which is 4- or 5-ovulate (1(–2) in *T. uniovulata*), the distinctly larger flowers and ratio of terminal leaflet length to lateral leaflet length (1.1–1.2 vs 1.3–1.8 in *T. uniovulata*). Also closely allied to *T. lasiochlaena* but differing in the number of ovules (1 in *T. lasiochlaena*), broader leaflets and inflorescences. Also related to *T. carriemichelliae*, with differences elucidated under that species.

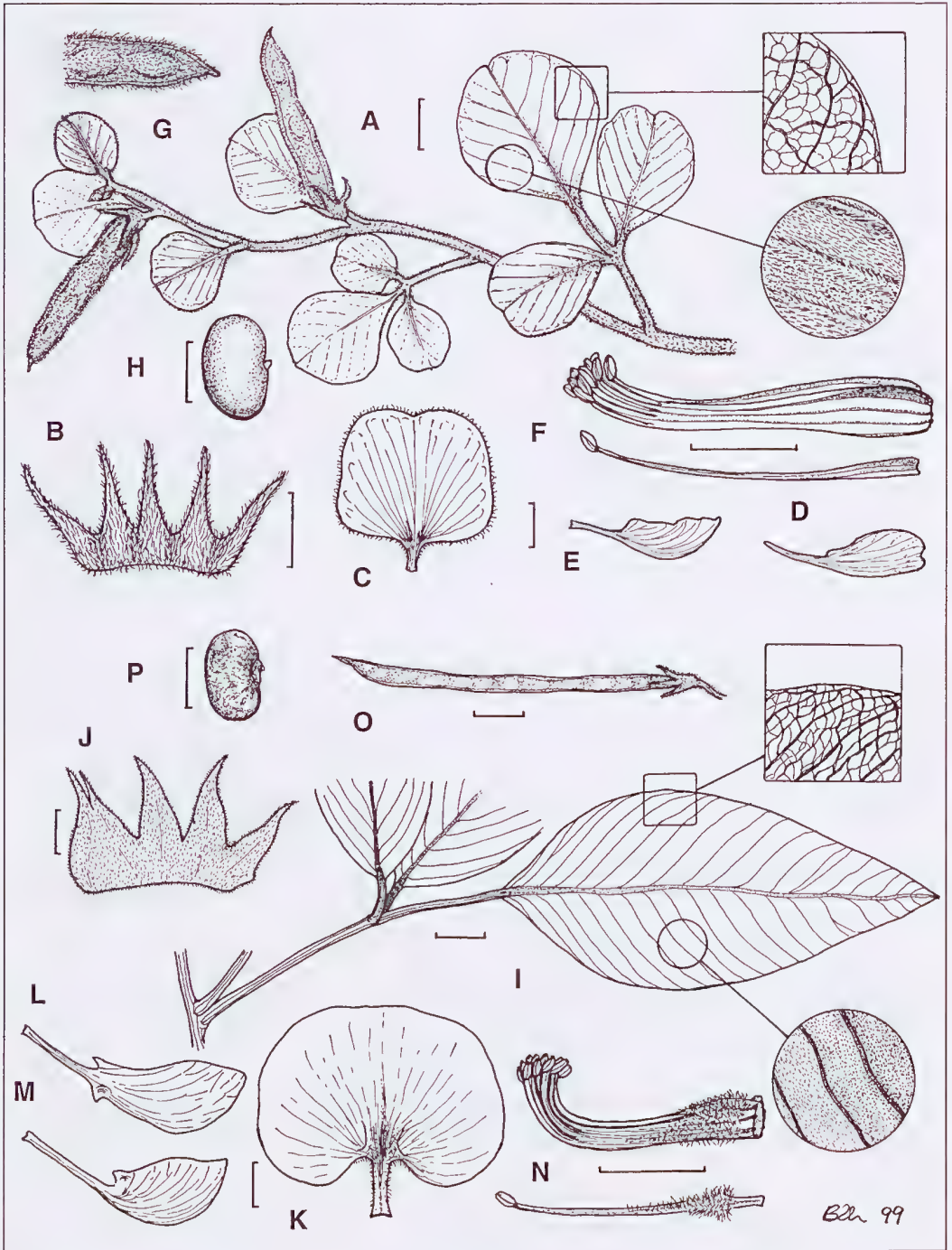


Figure 1. *Tephrosia andrewii*. A – habit showing details of venation and indumentum on leaflet undersurface, B – calyx (abaxial surface, vexillary lobes at LHS), C – standard, D – wing, E – keel, F – stamens, G – pod apex, H – seed. A – H from A.A. Mitchell 3024 (DNA). *Tephrosia procera*. I – leaf showing venation and indumentum on leaflet undersurface, J – calyx (abaxial surface, vexillary lobes at LHS), K – standard, L – wing, M – keel, N – stamens, O – pod, P – seed. I – N from G.J. Leach 2346 & C.R. Dunlop (DNA), O & P from I.D. Cowie 4182 (DNA). (A, I, O scale bar = 10 mm, others = 3 mm)

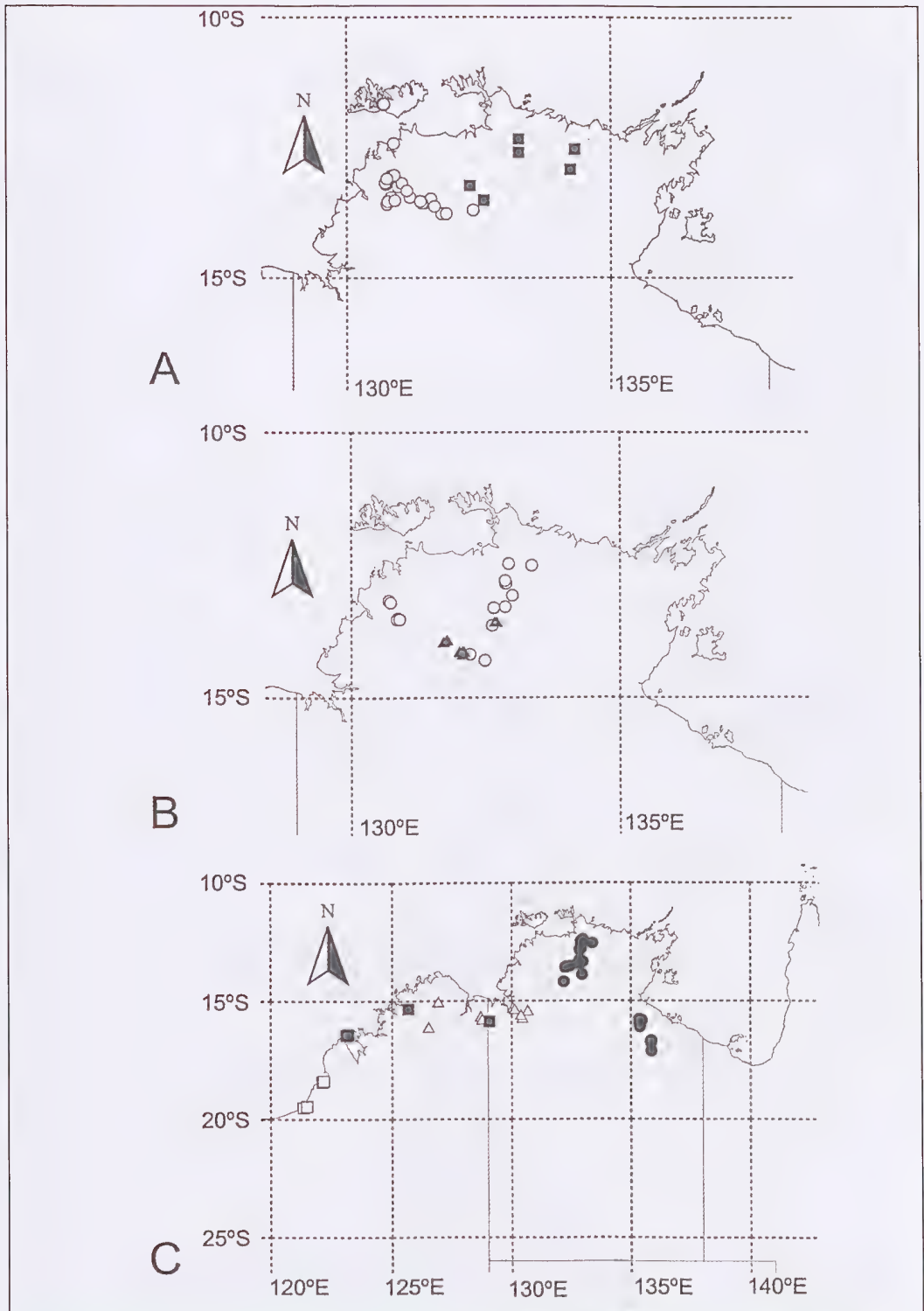


Figure 2. Geographic distribution of: A – *Tephrosia bifacialis* (○) and *T. humifusa* (■); B – *Tephrosia ephippioides* (○) and *T. carriemichelliae* (▲); C – *Tephrosia andrewii* (□), *T. gyropoda* (●), *T. procera* (△), and *T. valliculata* (■).

Tephrosia bifacialis I.D. Cowie, *sp. nov.*

A. T. lamproloboides foliis subsessilibus, foliolis 3, latioribus, valde discoloribus, prostratis differt.

Typus: Melville Island, Rd to Paru, NT, 21 Jan. 1991, *I.D. Cowie* 2181 & *G.J. Leach* (*holo:* DNA!; *iso:* BRI!, CANB!, K!, MEL!, MO!, NSW!, PERTH!).

Subshrub, prostrate, few-stemmed, perennial with annual aerial parts; taproot uniformly thickened. Branchlets, leaf and inflorescence rachis densely hairy, hairs ascending to patent, white to sometimes stramineous. *Leaves* digitately or pinnately 3-foliolate (rarely unifoliolate), ground hugging; stipules persistent, antrorse, attenuate, 3–6 mm long, dark brown; rachis 1–4 mm long to basal leaflets, 4–20 mm to terminal leaflet, 6–25 mm long overall; stipellae absent; *leaflets* (1)3; strongly discolorous; ovate to cuneate or suborbicular, flat, 24–97 mm long, 16–64 mm wide, 0.9–2.2(–2.7) times as long as wide; secondary veins in 10–18 pairs, intersecondary veins reticulate; upper surface glabrous, lower surface with prominently raised veins, densely hairy, hairs appressed or patent, white to stramineous, sometimes hoary; base rounded, apex obtuse to emarginate, sometimes apiculate, mucro absent or minute; terminal leaflet 1.3–1.7 times as long as laterals. *Inflorescence* racemose, ascending, terminal or axillary, to 0.5 m long, fascicles well spaced, 1–3-flowered. *Bracts* persistent, antrorse, attenuate, c. 4 mm long; pedicels 2–5 mm long; bracteoles present on pedicels. *Calyx* 4–9 mm long, densely hairy, hairs appressed to ascending, white; tube 2–3 mm long, equal to or shorter than lateral lobes; lobes attenuate to deltoid; vexillary lobes united higher than lower three, free for 1–3 mm; lowest lobe 1.5–6 mm long, distinctly longer than or sometimes equal to lateral lobes. *Corolla* orange or rarely yellow, standard 7–13 mm long, claw c. 1 mm long, blade subquadrate, calluses absent, apex emarginate to obcordate; wings 7–9.5 mm long, longer than keel, blade elliptic; keel 5–12 mm long, glabrous. *Staminal tube* hairy near fenestrae, fenestrae callused on margins; upper filament straight in lower half, callused near base, patent hairy. *Ovules* 6–12. *Style* flattened, uniform, glabrous; stigma penicillate at base. *Fruit* a pod, narrowly oblong, straight, compressed, 35–65 mm long, 6–7 mm wide, with loose, spongy tissue between seeds, white to pale brown, densely hairy, hairs ascending to patent, hyaline to white; beak central to eccentric, straight or slightly deflexed. *Seeds* 7–12 per pod, 4.5–6 mm between centres, smooth, whole coloured or mottled, olivaceous or black and pale brown, subglobular to oblong, 3–4.5 mm long; hilum central, or sometimes subapical; aril absent. Fig. 3 (J–Q).

Selected Specimens Examined. NORTHERN TERRITORY: Litchfield National Pk, 15 km WSW Adelaide River township, 13°15'55"S, 130°57'48"E, 5 Mar. 1996, *R. Booth* 1491 & *I.D. Cowie* (DNA); Blackfellow Creek, Daly River Road, 13°32'S 130°50'E, 14 Dec. 1966, *N. Byrnes* NB40 (DNA); 4.3 mls [6.9 km] NW of Pine Creek, 13°47'S, 131°47'E, 16 Mar. 1961, *G. Chippendale* NT7597 (DNA); 9 mls [14.4 km] S of Batchelor, 13°12'S, 131°02'E, 18 Mar. 1961, *G. Chippendale* NT7747 (DNA); Daly River Road, just N of Survey Creek, 13°36'S, 130°45'E, 11 Apr. 1993, *I.D. Cowie* 3841 (BRI, CANB, DNA); 12 km SSE of Adelaide River township, 13°20'48"S, 131°07'41"E, 26 Mar. 1994, *I.D. Cowie* 4631 (CANB, DNA, MEL); Litchfield National Pk, 13°03'29"S, 130°50'01"E, 14 Mar. 1995, *I.D. Cowie* 5267 & *S. Taylor* (BRI, CANB, DNA, MEL, NSW, PERTH); Litchfield National Pk, near Tableland Creek, 13°29'42"S, 130°51'19"E, 13 Feb. 1996, *I.D. Cowie* 6144 & *R. Booth* (BRI, DNA); Charles Darwin National Pk, 12°26'00"S, 130°52'50"E, 20 Feb. 1998, *R.K. Harwood* 306 (DNA); 70 mls [112 km] S of Darwin, Stuart Highway, 13°28'S, 130°50'E, 8 Aug. 1968, *P.K. Latz* 73 (DNA); Litchfield National Pk, road to Batchelor, 13°11'23"S, 130°43'7"E, 25 Nov. 1992, *G.J. Leach* 3358 (DNA); 3 km N of Hayes Creek, 13°30'S, 131°35'E, 5 Mar. 1978, *J.R. Maconochie* 2338 (AD, BRI, CANB, DNA, K, MEL, MO, NSW, NT, PERTH); Litchfield National Pk, 13°02'47"S, 130°53'22"E, 10 Feb. 1997, *C.R. Michell* 435 & *S. Calliss* (DNA); Hayes Creek area, 13°35'S, 131°25'E, 22 Mar. 1973, *J. Must* 1113 (BRI, CANB, DNA, K, L); Kakadu National Pk, Bloomfield Springs Track, c. 6 km W of Springs, 13°43'S 132°23'E, 27 Apr. 1990, *A.V. Slee* 2927 & *L.A. Craven* (DNA).

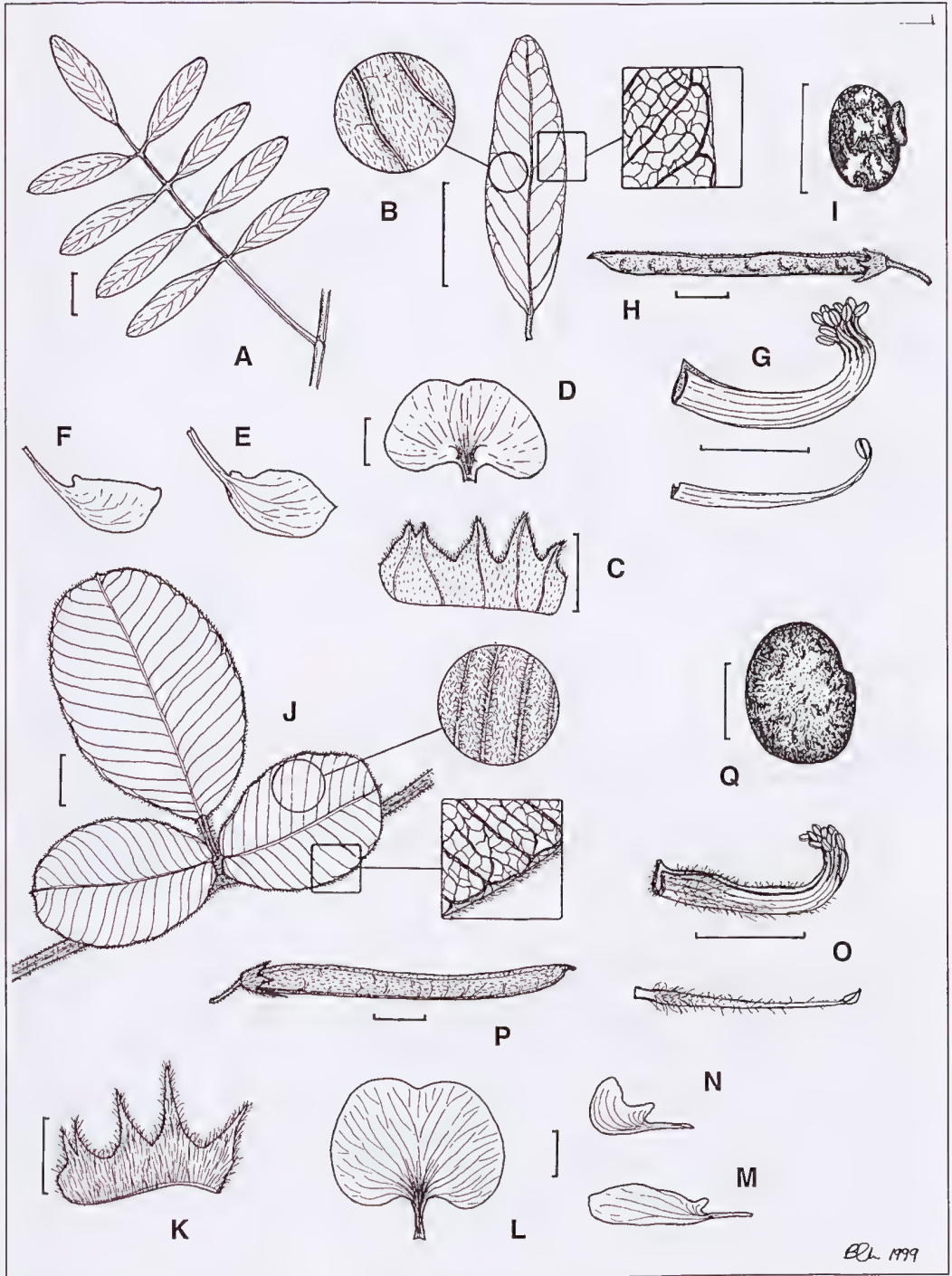


Figure 3. *Tephrosia gyropoda*. A – leaf, B – leaflet undersurface showing venation and indumentum, C – calyx (abaxial surface, vexillary lobes at LHS), D – standard, E – wing, F – keel, G – stamens, H – pod, I – seed. A – I from I.D. Cowie 8816 (DNA). *Tephrosia bifacialis*. J – leaf showing venation and indumentum on undersurface, K – calyx (abaxial surface, vexillary lobes at LHS), L – standard, M – wing, N – keel, O – stamens, P – pod, Q – seed. All from I.D. Cowie 2181 (DNA). (A, B, H, J, P scale bar = 10 mm, others = 3 mm).

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Distribution. Endemic to north western N.T. between Melville Island in the north, Daly River in the south west and southern Kakadu National Pk in the south east. Fig. 2A.

Habitat. Grows in *Eucalyptus* woodland, usually on stony soils, often with impeded internal drainage.

Flowering and fruiting. Flowers Nov. to Apr.; fruits Dec. to Apr.

Conservation status. No special conservation coding is recommended. The species is well represented in Litchfield National Pk and is at least known to occur in Kakadu National Pk. In much of its range it is relatively common in suitable habitat and is not considered threatened.

Etymology. The specific epithet is from the Latin *bi* meaning two and *facialis*, meaning facial and refers to the strongly discoloured leaves of this species.

Affinities. The species forms part of a group comprising *T. lamproloboides* and *T. reticulata*. It differs from *T. lamproloboides* in the almost sessile 3-foliolate leaves with broad, strongly discoloured, ground-hugging leaflets (as opposed to narrower, apparently simple, petiolate leaves which are concolorous to weakly discoloured in *T. lamproloboides*). Leaves of *T. reticulata* usually have 7–11 distinctly smaller, oblong leaflets, with a distinct rachis below the basal leaflets. Two incomplete specimens from the central Kimberley with 5 leaflets (e.g. *I.D. Cowie* 4173) are tentatively placed with *T. reticulata*. Another related species is *T. humifusa* and differences are discussed under that species.

Tephrosia carriemichelliae* I.D. Cowie, *sp. nov.

Species haec ab *T. andrewii* differt foliis simplicibus vel unifoliolis, grandioribus, calyce brevioribus lobis vexillaribus pro parte maxima connatis, carina secus marginem inferum pilifero, stylo pilifero secus laterem vexillare et leguminibus latioribus.

Typus: Yinberrie Hills, near Edith River, N.T. 25 January 1991, *I.D. Cowie* 1483 & *C.R. Dunlop* (holo: DNA!; iso: AD!, BRI!, CANB!, K!, L!, MEL!, MO!, NSW!, PERTH!, QRS!).

Subshrub, erect, multistemmed, perennial with annual aerial parts, to 0.5 m; rootstock unspecialised. Branchlets, leaf and inflorescence rachis very densely hairy, hairs ascending to patent, silvery. *Leaves* simple or unifoliolate; stipules persistent, antrorse, deltoid, 2–3 mm long, silvery; rachis to basal leaflet or petiole to 10 mm long; stipellae absent; *leaflets* concolorous; broadly ovate to transversely broadly elliptic, rarely obovate, flat, 40–70 mm long, 40–76 mm wide, 0.9–1.3 times as long as wide; secondary veins in 7–9 pairs, intersecondary veins reticulate, both surfaces densely hairy, hairs appressed to ascending, silvery; base rounded to cuneate, apex rounded to emarginate, mucro usually absent or rarely minute. *Inflorescence* fasciculate, axillary, c. 20 mm long, fascicles well spaced (rarely on a very short lateral axis), 2–4-flowered. *Bracts* caducous, antrorse, subulate, c. 2 mm long; pedicels 3–5 mm long; bracteoles usually absent. *Calyx* 7–9 mm long, densely hairy, hairs ascending, silvery; tube 3–4 mm long, equal to lateral lobes; lobes attenuate; vexillary lobes united higher than lower three, free for c. 1 mm; lowest lobe 4–9 mm long, distinctly longer than lateral lobes. *Corolla* orange, green in centre, standard c. 15 mm long, claw 2.5–3 mm long, blade transversely elliptic, calluses absent, apex rounded to emarginate; wings 13–14 mm long, equal to keel, blade oblanceolate; keel 13–14 mm long, appressed hairy along lower margin. *Staminal tube* glabrous near fenestrae, fenestrae callused on margins; upper filament straight in lower half, thickening gradually towards base, glabrous. *Ovules* 4–5. *Style* terete, tapering, bearded on vexillary side; stigma more or less penicillate. *Fruit* a pod, narrowly oblong,

straight, compressed and raised over seeds, 30–44 mm long, 8–9 mm wide, with loose, spongy tissue between seeds, silvery, densely hairy, hairs ascending, silvery; beak in line with upper suture, straight. *Seeds* 2–4 per pod, 5–7 mm between centres, smooth, whole coloured, brown, oblong, biconvex, 5–5.5 mm long; hilum central; aril absent. Fig. 4 (J–Q).

Other Specimens Examined. NORTHERN TERRITORY: low hills 2 km SE of Fisher Airstrip, 12°34'07"S, 132°39'09"E, 5 Mar. 1991, *K. Brennan* 1106 (DNA); 5.8 km S of Fergusson River, Stuart Highway, 14°08'S, 132°00' E, 14 Dec. 1991, *I.D. Cowie* 2141 (BRI, CANB, DNA, MEL); c. 20 km W of Pine Creek, Jindaree Road, 13°57'S, 131°42'E, 6 Mar. 1985, *C.R. Dunlop* 6769 (DNA, NT); Edith Falls Road, 14°11'08"S, 132°03'14"E, 26 Jan. 1993, *J.L. Egan* 1190 (DNA); Mount Todd Mine site, 14°07'54"S, 132°03'25"E, 17 Mar. 1995, *J.L. Egan* 4447 (DNA); road to Umbrawarra Gorge, 13°55'30"S, 131°45'09"E, 5 Apr. 1995, *J.L. Egan* 4646 (DNA); Umbrawarra Gorge road, 11 km from Stuart Hwy, 13°54'42"S 131°46'09"E, 12 Jan. 1999, *J. Risler* 67 & *R.A. Kerrigan* (DNA); 55 km N of Katherine, old Edith River Falls road, 14°08'S, 132°05'E, 16 Feb. 1987, *S. Tidemann* 47 (DNA); Mt Todd, 14°08'S, 132°03'E, undated, *B. Wilson* 183 (DNA).

Distribution. Endemic to the northern part of the Northern Territory, where it is well known from the Yinberrie Hills north west of Katherine, but also occurring south west of Pine Creek and in the southern part of Kakadu National Pk. Fig. 2B.

Habitat. Grows on ridges in *Eucalyptus* woodland with *Sorghum* understorey, in coarse sandy or gravelly soils frequently of granitic origin.

Flowering and fruiting. Flowers Dec. to Feb.; fruits Mar. to Apr.

Conservation status. No special conservation status is recommended. The plant is common within a relatively restricted range and occurs in the southern part of Kakadu National Pk.

Etymology. Named in honour of the late Caroline (Carrie) Robyn Michell, dear friend and valued colleague to all at DNA, who met a recent untimely death. Her methodical approach, keen eye and hard work greatly increased knowledge of the flora of the Yinberrie Hills and adjacent Nitmiluk (Katherine Gorge) National Pk, near Katherine, NT.

Affinities. The species is similar to *T. andrewii* but has simple or unifoliolate leaves with blades 40–70 mm long and 40–76 mm wide (as opposed to 1–5-foliolate leaves with leaflets 15–31 mm long and 12–29 mm wide in *T. andrewii*), a shorter calyx (7–9 mm vs 9–11 mm) with largely connate vexillary lobes (divided to the same depth as the lower three in *T. andrewii*), hairs on the outer margin of the keel and on the vexillary side of the terete style and a broader pod (8–9 mm vs 6.5–7 mm). The species also has affinities with *T. uniovulata* and *T. lasiochlaena*, but in these species the vexillary calyx lobes are largely divided to the same depth as the lower three, the vexillary staminal filament is callused near the base, the style is flattened and both have ovaries with 1 (rarely 2) ovules and 1 or 3-foliolate leaves. In *T. lasiochlaena*, the crowded upper leaves with flowers in axillary fascicles usually form a leafy, congested false spike.

Tephrosia ephippioides* I.D. Cowie, *sp. nov.

A *T. gyropoda* indumento aureolo brunneo, foliolis angustioribus, tubo staminale ad fenestras piloso et caruncula grandiore, complanata differt.

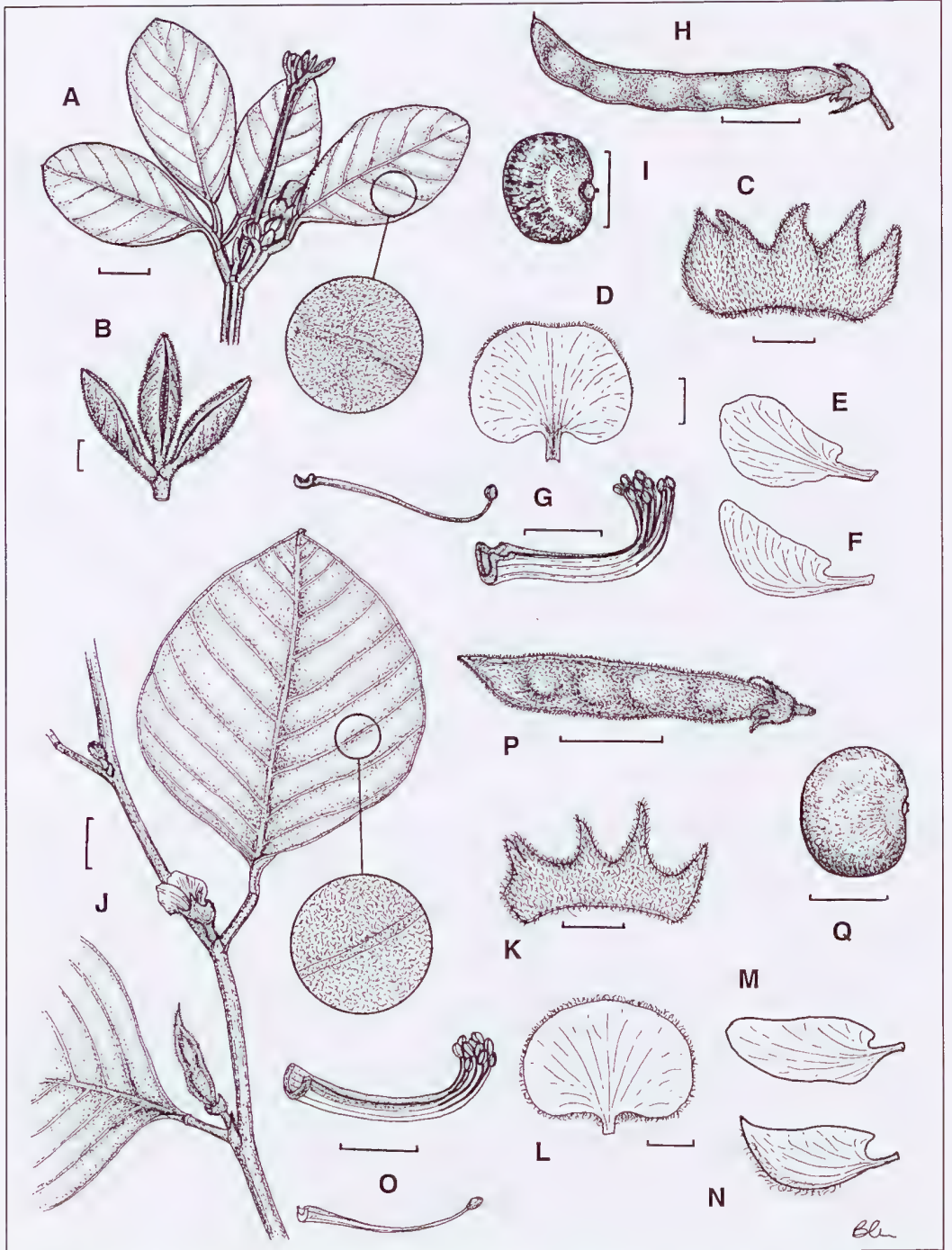


Figure 4. *Tephrosia valleculata*. A – flowering shoot showing venation and indumentum on leaflet undersurface, B – young leaf, C – calyx (abaxial surface, vexillary lobes at LHS), D – standard, E – wing, F – keel, G – stamens, H – pod, I – seed. A – I from G.M. Wightman 7110 (DNA). *Tephrosia carriemichelliae*. J – habit showing venation and indumentum on leaflet undersurface, K – calyx (abaxial surface, vexillary lobes at LHS), L – standard, M – wing, N – keel, O – stamens, P – pod, Q – seed. J – O from I.D. Cowie 1483 & C.R. Dunlop (DNA), P from J. Egan 4447, Q from J. Egan 4646. (A, H, J, P scale bar = 10 mm, others = 3 mm).

Typus: Kakadu National Pk, track to Gubara (Baroalba Spring), NT, 7 Apr. 1994, I.D. Cowie 4845 (*holo*: DNA!; *iso*: BRI!, CANB!, K!, L, MEL!, NSW!, PERTH!).

Shrub, erect, few-stemmed, perennial, to 2 m; rootstock unspecialised. Branchlets, leaf and inflorescence rachis sparsely hairy, hairs short, appressed, yellow brown. *Leaves* imparipinnate; stipules caducous, antrorse, subulate, 2–5 mm long, dark brown; rachis 9–24 mm long to basal leaflets, 9–21 mm between leaflets, 3–15 mm to terminal leaflet, 54–130 mm long overall; stipellae absent; leaflets 11–21, concolorous or slightly discolorous; linear to oblanceolate, flat, (19–)26–46 mm long, 3–9(–19) mm wide, (2.9–)4.7–12 times as long as wide, uniform along rachis or larger towards apex; secondary veins in 7–15 pairs, intersecondary veins reticulate, upper surface glabrous to sparsely hairy, hairs short, appressed or patent, hyaline, lower surface sparsely hairy, hairs short, appressed, hyaline to yellow-brown; base rounded to cuneate, apex acute to obtuse, mucro minute; terminal leaflet 0.7–1.3 times as long as laterals. *Inflorescence* racemose, terminal or axillary, 90–220 mm long, fascicles well spaced, 1–3-flowered. *Bracts* caducous, antrorse, subulate, c. 2 mm long; pedicels 3–8 mm long; bracteoles almost always absent. *Calyx* 3.5–6 mm long, moderately hairy, hairs appressed, yellow-brown; tube 2–2.5 mm long, equal to lateral lobes; lobes attenuate; vexillary lobes united higher than lower three, free for 0.7–1.5 mm; lowest lobe 2–3.5 mm long, distinctly longer than lateral pair. *Corolla* orange, standard 9–12 mm long, claw 2–2.5 mm long, blade depressed ovate, slightly callused at base, apex retuse; wings 9.5–12 mm long, longer than keel, blade obovate; keel 8–9.5 mm long, glabrous. *Staminal tube* hairy near fenestrae, fenestrae callused on margins and at apex; upper filament straight or slightly geniculate in lower half, callused near base, appressed to patent hairy. *Ovules* 7–10. *Style* flattened, uniform, glabrous; stigma penicillate at base. *Fruit* a pod, linear, upcurved near apex, turgid, 38–60 mm long, 3.3–4.2 mm wide, with loose, spongy tissue between seeds, pale brown to yellow-brown, sparsely to moderately hairy, hairs appressed, yellow-brown; beak in line with upper suture, straight. *Seeds* 7–10 per pod, 4–5.5 mm between centres, smooth, mottled, pale and dark brown to black, flattened-ellipsoid to oblong, 2.5–3.6 mm long; hilum subapical; aril flattened, green, asymmetric, 1.1–1.3 mm long. Fig. 5 (J–R).

Other Specimens Examined. NORTHERN TERRITORY: Litchfield National Pk, southern part, 13°31'16"S, 130°50'10"E, 15 Feb. 1996, R. Booth 1455 & I.D. Cowie (DNA); Katherine Gorge, 14°18'S 132°28'E, 16 Jan. 1967, N. Byrnes NB65 (DNA); Katherine Gorge National Pk, 14°18'S 132°28'E, 8 Feb. 1970, N. Byrnes 2049 (DNA); Daly River Rd, E of Reynolds River, 13 31'S, 130 53'E, 11 Apr. 1993, I.D. Cowie 3843 (BRI, CANB, DNA, MEL); Litchfield National Pk, Wangi Falls, 13°09'50"S, 130°41'03"E, 27 Dec. 1993, I.D. Cowie 4541 (CANB, DNA, MEL); top of Jim Jim Falls, 13°17'S, 132°51'E, 30 Jan. 1981, C.R. Dunlop 5671 (BRI, CANB, DNA, NSW, NT), Tolmer Falls, 13°12'S, 130°43'E, 5 Apr. 1991, C.R. Dunlop 8801 & I.D. Cowie (DNA); Edith Falls, 14°11'00"S, 132°11'24"E, 13 Apr. 1995, J.L. Egan 4740 (CANB, DNA); Deaf Adder Gorge, 13°04'S, 132°59'E, 23 Feb. 1977, R.E. Fox 2544 (DNA); Nabarlek, 12°30'S, 133°21'E, 10 Feb. 1989, R. Hinz 411 (DNA); Ngarradj warde djobkeng, Kakadu National Pk, 12°28'S, 132°55'E, 2 Feb. 1984, J. Russell-Smith 1062 (BRI, DNA).

Distribution. This species occurs in the north western part of the Northern Territory extending from Nabarlek in western Arnhem Land (i.e. land belonging to the Arnhem Land Aboriginal Land Trust) south to Nitmiluk (Katherine Gorge) National Pk and west to the Tabletop Range in Litchfield National Pk. Fig. 2B.

Habitat. Grows in *Eucalyptus* savanna or shrubland amongst sandstone outcrops and boulders or on sandsheets associated with sandstone outcrops.

Flowering and fruiting. Flowers Dec. to Feb.; fruits Mar. to Apr.

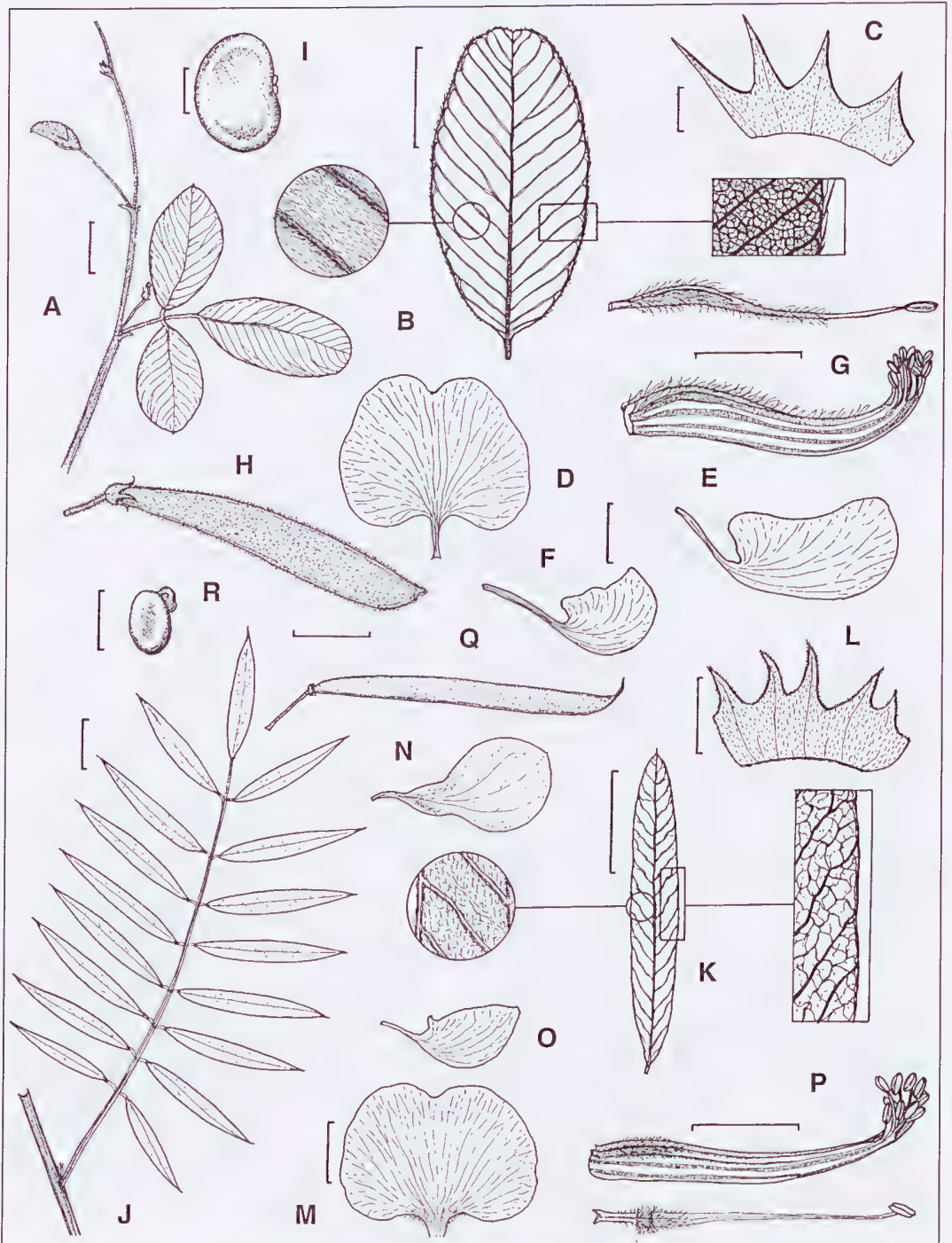


Figure 5. *Tephrosia humifusa*. A – habit, B – leaflet undersurface showing venation and indumentum, C – calyx (abaxial surface, vexillary lobes at RHS, appearing connate), D – standard, E – wing, F – keel, G – stamens, H – pod, I – seed. A – G from *M. Lazarides* 7989 (DNA), H & I from *M. Lazarides* 7765 (DNA). *Tephrosia ephippioides*. J – leaf, K – leaflet undersurface showing venation and indumentum, L – calyx (abaxial surface, vexillary lobes at RHS), M – standard, N – wing, O – keel, P – stamens, Q – pod, R – seed. J, K, Q, R from *I.D. Cowie* 4845 (DNA), L – P from *I.D. Cowie* 8238 (DNA) (A, B, H, J, K, Q scale bar = 10 mm, others = 3 mm).

Conservation status. No special conservation coding is recommended. Most of the known range of the species lies in within Kakadu, Nitmiluk (Katherine Gorge) and Litchfield National Pks. In these areas it is relatively common in suitable habitat and is not considered threatened.

Etymology. The epithet is from the Latin *ephippioideus*, meaning saddle-shaped and refers to the flattened, saddle-like aril present on the seed of this species.

Affinities. This species is most closely related to *T. gyropoda* but differs particularly in the golden brown indumentum, narrower leaflets, staminal tube hairy at the fenestrae and in the larger, flattened aril. It is also related to *T. oblongata*, but has much smaller narrower leaflets, shorter floral bracts (c. 2 mm vs 5–15 mm) and smaller flowers.

Tephrosia gyropoda* I.D. Cowie, *sp. nov.

A *T. ephippioides* praecipue indumento candido ad hyalino, foliolis latioribus, tubo staminale ad fenestras glabro et caruncula minuta, annulari differt.

Typus: Kakadu National Pk, near East Alligator Ranger Station, 12°25'53"S, 132°57'03"E, 21 Apr 1999, I.D. Cowie 8316 (*holo:* DNA! (2 sheets); *iso:* BRI!, CANB!, K!, L!, MEL!, MO!, NSW!, NY!, PERTH!).

Shrub, erect, multistemmed, perennial, to 3 m; rootstock unspecialised. Branchlets, leaf and inflorescence rachis sparsely hairy, hairs appressed, white to hyaline. *Leaves* imparipinnate; stipules caducous, antrorse, subulate, 3–4.5 mm long, dark brown; rachis 13–42 mm long to basal leaflets, 12–22 mm between leaflets, 6–17 mm to terminal leaflet, (25–)50–125 mm long overall; stipellae absent; *leaflets* (5–)7–13(–15), almost concolorous, ovate to elliptic (sometimes narrower), flat, 23–53 mm long, 6–23 mm wide, 2.1–3.8 times as long as wide, larger towards base; secondary veins in 12–15 pairs, intersecondary veins reticulate, both surfaces sparsely hairy, hairs short, appressed, white to hyaline; base rounded, apex acute to rounded, mucro minute; terminal leaflet 0.7–1.6 times as long as laterals. *Inflorescence* racemose, sometimes branched, terminal or axillary, to 360 mm long, fascicles well spaced, 1- or 2-flowered. *Bracts* caducous, antrorse, lanceolate, 1–2 mm long; pedicels 2–5 mm long; bracteoles absent. *Calyx* 2–6 mm long, moderately hairy, hairs appressed, white to hyaline; tube 1–2.5 mm long, longer than or sometimes equal to lateral lobes; lobes deltoid to broadly deltoid; vexillary lobes united higher than lower three, free for 0.5–1 mm; lowest lobe 1–4 mm long, equal to or distinctly longer than lateral lobes. *Corolla* orange, standard 7–9.5 mm long, claw c. 2 mm long, blade transversely oblong to transversely reniform, callused at base, apex emarginate; wings 5.5–9 mm long, longer than keel, blade obovate to oblanceolate; keel 5.5–8 mm long, glabrous. *Staminal tube* glabrous near fenestrae, fenestrae slightly callused on margins; upper filament straight in lower half, slightly callused near base, glabrous. *Ovules* 7–9. *Style* flattened, uniform, glabrous; stigma penicillate at base. *Fruit* a pod, linear, upcurved near apex, compressed and raised over seeds, 44–65 mm long, 3.5–5.5 mm wide, with loose, spongy tissue between seeds, pale brown to dark brown, sparsely hairy, hairs short, appressed, hyaline; beak in line with upper suture, straight. *Seeds* 6–8 per pod, 6–7.5 mm between centres, smooth, mottled, pale and dark brown, flattened ellipsoid to oblong, 3.2–4.2 mm long; hilum eccentric to subapical; aril annular, white to greenish, 0.7–1 mm long. Fig. 3 (A–I).

Selected Specimens Examined. NORTHERN TERRITORY: Kakadu National Pk, near top of Moline Rock Hole, 13°34'22"S, 132°15'26"E, 12 May 1997, I.D. Cowie 7546 (BRI, CANB, DNA, K, MEL,

NSW, PERTH); Kakadu National Pk, N side of Mt Brockman, 12°44'S, 132°54'E, 23 Feb. 1973, L.A. Craven 2356 (CANB, DNA); Kakadu National Pk, 6 km ESE of Twin Falls, 13°22'S, 132°48'E, 24 May 1980, L.A. Craven 5835 (CANB, DNA); Kakadu National Pk, c. 18 km SE of Jabiru, 12°48'S, 132°55'E, 30 Mar. 1981, L.A. Craven 6649 (CANB, DNA); Kakadu National Pk, top of Jim Jim Falls, 13°17', 132°51', 29 Jan. 1981, C.R. Dunlop 5655 (BRI, CANB, DNA, MEL, NSW, PERTH); Kakadu National Pk, c. 70 km NE of Pine Creek, 13°33'S, 132°18'E, 5 Mar. 1985 C.R. Dunlop 6765 & G.M. Wightman (BRI, CANB, DNA); Kakadu National Pk, Mt Brockman, 12°47'51"S, 132°54'36"E, 27 Mar. 1995, J.L. Egan 4491 (BRI, DNA, MEL); Red Lilly Lagoon area between Cahills Crossing and Oenpelli, 12°24'S, 133°00'E, 27 May 1973, T.G. Hartley 13726 (CANB, DNA); 44 km SE of Oenpelli, 12°34'S, 133°23'E, 15 June 1978 P.K. Latz 7792 (BRI, CANB, DNA); c. 40 km SSW of Nathan River Homestead, 15°56'S, 135°20'E, 27 Aug. 1985, P.K. Latz 10124 (BRI, DNA); 28 km S of Nathan River Homestead, 15°48'29"S, 135°26'26"E, 16 Sept. 1995, P.K. Latz 14576 (BRI, DNA, NT); Alligator Yard, c. 20 km NW of Bauhinia Downs Station, 16°05'S, 135°22'E, 5 May 1985, G.J. Leach 569 (CANB, DNA, K, MEL, NSW, NT); Kakadu National Pk, headwaters of Twin Falls Creek, 13°26'43"S, 133°51'04"E, 19 Apr. 1995, G.J. Leach 4344 & L. Greschke (BRI, CANB, DNA, NSW); 30 mls [48 km] S of McArthur River Station, 17°6'S, 135°51'E, 24 July 1948, R.A. Perry 1723 (CANB, DNA); Arnhem Land, between East Alligator River and Oenpelli, 12°25'S, 133°00'E, 3 June 1974, R. Pullen 9459 (CANB, DNA); Bulilumbu (Cannon Rock) on Jabiluka outlier, 12°32'S, 132°54'E, 27 Aug. 1980, C.F. Puttock 10246 & J.T. Waterhouse (DNA, UNSW); Three Pools, 14 km S of Cannon Hill, 12°9'S, 132°54'E, 5 Jan. 1984, J. Russell-Smith 914 (BRI, DNA); Ja Ja Massif, 4 km N of Ja Ja camp, 12°31'S, 132°54'E, 3 Feb. 1984, J. Russell-Smith 1053 (BRI, DNA); Edith River Falls, 14°11'S, 132°11'E, 27 Feb. 1965, I.B. Wilson 356 (CANB, DNA).

Distribution. Endemic to the northern NT from western Arnhem Land and Kakadu National Pk south to McArthur River Station near Borroloola. Fig. 2C.

Habitat. Grows in *Eucalyptus* savanna or shrubland, usually among sandstone outcrops or boulders on sand.

Flowering and fruiting. Flowers Jan. to Sept.; fruits Mar. to Sept.

Conservation status. No special conservation coding is recommended. The species is well conserved and no threats are known. It has a fairly wide distribution, with populations occurring in Kakadu National Pk and Nitmiluk (Katherine Gorge) National Pk.

Etymology. The epithet is from the Greek *gyros*, a ring or circle and *podion*, a foot and refers to the annular aril present on the seed of this species.

Affinities. Most closely related to *T. ephippioides*, but differing particularly in the white to hyaline indumentum (rather than golden brown in that species), broader leaflets (lanceolate to elliptic rather than linear to narrowly elliptic in *T. ephippioides*), staminal tube glabrous at the fenestrae (vs hairy in *T. ephippioides*) and aril (minute, annular vs larger and flattened in *T. ephippioides*).

Tephrosia humifusa* I.D. Cowie, *sp. nov.

Affinis *T. bifacialis* a qua pedicellis distincte longioribus, inflorescentia prona, corolla purpurea, semenibus paucioribus, grandioribus et leguminibus latioribus differt.

Typus: Arnhem Land; headwaters of Cadell R., c. 98 km S of Maningrida, NT, 12°56'12"S 134°13'32"E, 22 Mar. 2000, I.D. Cowie 8711 (*holo*: DNA!; *iso*: AD!, BRI!, CANB!, K!, L!, MEL!, MO!, NY!, PER!).

Subshrub, prostrate, multistemmed, perennial with annual aerial parts, taproot uniformly thickened. Branchlets, leaf and inflorescence rachis sparsely hairy, hairs appressed to patent, white to stramineous. *Leaves* pinnately 3-foliolate; stipules persistent, antrorse, attenuate to deltoid, 3–5 mm long, brown; rachis 3–12 mm long to basal leaflets, 2–12 mm to terminal leaflet, 5–23 mm long overall; stipellae absent; *leaflets* usually 3 (rarely 1 or 5); discolourous to strongly discolourous; ovate to oblong-obovate or broadly obovate, flat, 18–40 mm long, 14–29 mm wide, 1.4–2 times as long as wide; secondary veins in 10–15 pairs, intersecondary veins reticulate, upper surface glabrous, lower surface with raised veins, moderately hairy, hairs appressed, white to stramineous; base rounded to broadly cuneate, apex obtuse to emarginate, mucro absent or minute; terminal leaflet 1.2–1.4 times as long as laterals. *Inflorescence* racemose, terminal or leaf opposed, prostrate, to 270 mm long, fascicles well spaced, 2-flowered. *Bracts* persistent, antrorse, attenuate to deltoid, 1.5–3 mm long; pedicels 9–17 mm long; bracteoles absent. *Calyx* 4–6 mm long, sparsely hairy, hairs appressed, white to stramineous; tube 2–3 mm long, shorter than to longer than lateral lobes; lobes attenuate to deltoid; vexillary lobes united higher than lower three, free for c. 1 mm; lowest lobe 2–4 mm long, equal to or sometimes distinctly longer than lateral pair. *Corolla* purple, standard 10–14 mm long, claw 2–3 mm long, blade transversely oblong to transversely reniform, slightly callused at base, apex emarginate to obcordate; wings 10–14 mm long, blade elliptic to obovate, wings longer than keel; keel 8.5–10 mm long, glabrous. *Staminal tube* hairy at fenestrae, fenestrae callused on margins; upper filament straight in lower half, callused near base, patent hairy. *Ovules* 4–7. *Style* flattened, uniform, glabrous; stigma penicillate at base. *Fruit* a pod, narrowly oblanceolate-oblong, straight or slightly curved, compressed and raised over seeds, 35–58 mm long, 7–9 mm wide, tissue usually absent between seeds, pale brown, moderately hairy, hairs patent, white to stramineous; beak eccentric, slightly deflexed. *Seeds* 4–6 per pod, 6–7.5 mm between centres, smooth, whole coloured, olivaceous to brown, ellipsoid to oblong, 5.5–6 mm long; hilum eccentric; aril absent. Fig. 5 (A–I).

Other Specimens Examined. NORTHERN TERRITORY: track from Nabarlek to Tin Camp Creek, 12°21'S, 133°15'E, 18 Feb. 1992, K. Brennan 1845 (DNA); Arnhem Land, c. 53 km SSE of Maningrida, 12°32'47", 134°18'41"E, 11 Apr. 2000, I.D. Cowie 8804 (CANB, DNA, MEL); c. 26 miles E of Mudginberry Homestead, 12°36'S, 133°15'E, 19 Feb. 1973, M. Lazarides 7765 (CANB, DNA); Kakadu National Pk, c. 19 mls [30 km] SE of Mt Basedow, 13°15'S, 132°19'E, 3 Mar. 1973, M. Lazarides 7989 (CANB (2 sheets), DNA); Koolpin Creek area, 13°32'S, 132°35'E, 28 Nov 1978, M.O. Rankin 1627 (DNA).

Distribution. Endemic to northern N.T., in Kakadu National Pk and in Arnhem Land to as far east as near Maningrida. Fig. 2A.

Habitat. In *Eucalyptus* savanna, often on clayey soils derived from dolerite or siltstone.

Flowering and fruiting. Flowers Feb. to Mar.; fruits Feb. to Apr.

Conservation status. Although the species is relatively uncommon, no special conservation coding is recommended as it is well conserved and is under no apparent threat. The entire range of the species lies in Kakadu National Pk or in Arnhem Land

Etymology. The epithet for this species is from the Latin *humifusus* meaning spread out over the ground or procumbent and refers to the ground-hugging habit of the plant.

Affinities. This species is most closely related to *T. bifacialis* but *T. humifusa* has distinctly longer petioles and pedicels, a prostrate inflorescence, purple corolla, fewer, larger, more widely spaced seeds and broader, narrowly oblanceolate-oblong pods. It is unusual among *Tephrosia* with reticulate intersecondary nerves in having a purple corolla and usually a lack of tissue between seeds, a characters normally found only in those species with type (i) or (ii) venation.

Tephrosia procera I.D. Cowie, *sp. nov.*

A *T. conspicua* W.V. Fitzg. foliolis glabris ad sparsim pilosis, ovatis ad late ellipticis, bracteis floralibus brevioribus, angustioribus, carina secus marginem inferum pilifero, ovulis et seminibus paucioribus separata.

Typus: Little Horse Creek, near Timber Creek, 15°02'S, 130°27'E, 6 Mar. 1989, G.J. Leach 2346 & C.R. Dunlop (*holo:* DNA! – 2 sheets; *iso:* BRI, CANB, MEL!, K, MO!).

Illustration. *Tephrosia* sp. A (Wheeler, 1992)

Shrub, erect, few-stemmed, perennial, to 5 m, bark corky; rootstock unspecialised. Branchlets, leaf and inflorescence rachis sparsely hairy, hairs appressed, white to slightly yellow-brown. *Leaves* usually digitately 3-foliolate or imparipinnate, rarely 1-foliolate; stipules caducous, antrorse, attenuate, 4–9 mm long, red brown; rachis 6–37 mm long to leaflet or basal leaflets, 26–36 mm between leaflets, 4–30 mm to terminal leaflet, 6–100 mm long overall; stipellae absent; *leaflets* (1–)3–5, coriaceous, slightly discolorous, ovate to broadly elliptic, flat, 31–98 mm long, 14–60 mm wide, 1.6–2.2 times as long as wide, larger towards apex; secondary veins in 12–24 pairs, intersecondary veins reticulate, upper surface with raised veins, glabrous to sparsely hairy, hairs appressed, white, lower surface with raised veins; sparsely hairy, hairs appressed, white to slightly yellow-brown, base rounded or attenuate or broadly cuneate, apex acute to emarginate, mucro minute; terminal leaflet 1–1.4 times as long as laterals. *Inflorescence* racemose, sometimes branched, terminal or axillary, to 400 mm long, fascicles well spaced, 1–3-flowered. *Bracts* caducous, antrorse, attenuate to lanceolate, acuminate, 2–3 mm long; pedicels 5–7 mm long; bracteoles usually absent. *Calyx* 6–9 mm long, moderately hairy, hairs appressed, white to slightly yellow-brown; tube c. 3 mm long, shorter than to longer than lateral lobes; lobes attenuate to narrowly deltoid, vexillary lobes united higher than lower three, free for 1–1.5 mm; lowest lobe 3–6 mm long; distinctly longer than lateral lobes. *Corolla* orange, with a green throat, standard 12–14 mm long, claw 3–4 mm long, blade transversely reniform, callused at base, apex rounded to emarginate; wings 14–15 mm long, longer than keel, blade elliptic; keel 10–11 mm long, hairy along lower margin. *Staminal tube* hairy near fenestrae, fenestrae callused on margins and at apex; upper filament slightly geniculate and callused near base, appressed hairy to densely patent hairy. *Ovules* 7–13. *Style* flattened, uniform, glabrous; stigma penicillate at base. *Fruit* a pod, linear, scarcely upcurved near apex, turgid, 45–90 mm long, c. 4 mm wide, with loose, membranous tissue between seeds, pale to dark brown, moderately hairy, hairs short, appressed and patent, white to stramineous; beak in line with upper suture, straight. *Seeds* 7–12 per pod, 5–6.5 mm between centres, smooth, mottled, pale and dark brown, oblong, slightly flattened, 3.2–4 mm long; hilum central; aril annular, white, c. 0.9 mm long. Fig. 1 (I–P).

Other Specimens Examined. WESTERN AUSTRALIA: Kununurra, near the cotton gin, 15°46'S 128°45'E, 14 Feb. 1977, A.L. Chapman 2 (PERTH); Kalumburu Road near Gibb River Crossing, 16°05'48"S 126°30'40"E, 21 May 1993, I.D. Cowie 4182 (BRI, CANB, DNA, MEL, NSW, PERTH);

near junction of Mogurnda Creek and Drysdale River, 15°02'S, 126°05'E, 6 Aug. 1975, A.S. George 13462, (PERTH); Kununurra, near the cotton gin, 15°46'S 128°45'E, 10 Jan. 1978, R.J. Petheram s.n. (PERTH).

NORTHERN TERRITORY: Bradshaw Station, Koolendong Valley, 15°16'33"S, 130°02'55"E, 18 Feb. 1999, C.R. Michell 2163, J. Russell-Smith & C. Yates, (DNA, MEL, PERTH); Bradshaw Station, 15°23'47"S, 130°40'33"E, 22 Feb. 1999, C.R. Michell 2285 & C. Yates, (BRI, DNA); Timber Creek area, 15°35'S, 130°23'E, 4 Nov. 1992, G.M. Wightman 5963 (DNA); Bradshaw Station, Barramundi Pump, 15°20'S, 130°07'E, 4 June 1997, G.M. Wightman 6990 (DNA).

Distribution. Endemic to the Kimberley region of W.A. and adjacent parts of the N.T., from near Drysdale River in the west to near Timber Creek in the east. Fig. 2C.

Habitat. Grows in sandy soil, usually amongst sandstone outcrops.

Flowering and fruiting. Flowers Jan. to Mar.; fruits Feb. to May.

Conservation status. No special conservation coding is recommended. The species is distributed across a relatively wide range and is found in Gregory National Pk in the NT. There is no immediate threat to the conservation status of the species as the region is sparsely settled with low intensity cattle grazing the predominant land use. The sandy, infertile and often skeletal soils on which it grows are unattractive for grazing and for development for intensive agriculture.

Etymology. The specific epithet is from the Latin *procera* meaning very tall and refers to the unusual stature of the plant (for a species of *Tephrosia*), which is reported to be up to 5 m in height

Affinities. The species is most closely allied to *T. conspicua* but differs in the glabrous to sparsely hairy leaflets (sericeous, often silvery in *T. conspicua*), shorter, narrower floral bracts (2–3 mm vs 4.5–15 mm long, frequently ovate or broader in *T. conspicua*), keel hairy along the outer margin (glabrous in *T. conspicua*) and the fewer ovules (7–13 vs 14–20 in *T. conspicua*). In the northern and eastern NT, *T. conspicua* also has oblanceolate to obovate leaflets. *Tephrosia procera* is also allied to *T. coriacea*, but differs in the leaves (usually 3 or 5-foliolate as opposed to usually unifoliolate in *T. coriacea*), in the racemose inflorescence (flowers in axillary fascicles in *T. coriacea*), the habit (a tall erect shrub vs a low multistemmed shrub), glabrous fenestrae, 7–13-ovulate ovary (vs 5 or 6-ovulate in *T. coriacea*) and longer pods. An incomplete collection from Shark Point, near Borrooloola in the NT (P.K. Latz 11133 (DNA)) may also be referable to *T. procera*.

Tephrosia valleculata I.D. Cowie, *sp. nov.*

Tephrosia lasiochlaenae affinis sed ovulis quatuor ad septem; leguminibus leviter curvis, seminibus quatuor ad septem, rostro leguminis recto, in latere vexillari affixo, et fasciculis non nisi axillis supero pauco separata.

Typus: Keep River National Pk, N.T. [precise locality withheld], 21 Apr 1999, G.M. Wightman 7110 (*holo:* DNA!; *iso:* BRI!, MEL!, PERTH!).

Tephrosia flammea Benth. var. *pilosa* C.A. Gardner, *Western Australian Forests Department Bulletin no. 32, Botanical Notes – Kimberley Division of Western Australia* 3: 56 (1923). *Typus*: near Mt Agnes and Moran River, W.A., 26 June 1921, C.A. Gardner 1424 (holo: PERTH!)

Shrub, erect, few-stemmed, perennial, to 2 m; rootstock not seen. Branchlets, leaf and inflorescence rachis densely hairy, hairs ascending to patent, silvery to ferruginous. *Leaves* unifoliolate to pinnately 3-foliolate, or sometimes imparipinnate; stipules caducous, antrorse, subulate to deltoid, 1–5 mm long, silvery; rachis 2–7(–20) mm long to basal leaflets, 7–14 mm between leaflets, 0–3 mm to terminal leaflet, 2–12(–43) mm long overall; stipellae absent; *leaflets* 1 or 3(–5 in juvenile plants); slightly discolorous; ovate to obovate or oblanceolate, flat, 17–48(–61) mm long, 8–31 mm wide, 1.4–2 times as long as wide, larger towards apex; secondary veins in 4–8 pairs, intersecondary veins reticulate, upper surface with raised veins, densely hairy, hairs appressed to ascending, silvery to ferruginous, lower surface with raised veins, densely hairy, hairs appressed to ascending, silvery to ferruginous; base cuneate, apex usually rounded, mucro minute; terminal leaflet 1.1–1.4 times as long as laterals. *Inflorescence* fasciculate, axillary, c. 10 mm long, fascicles often crowded, few and on short lateral shoots, 2–5-flowered. *Bracts* persistent, antrorse, subulate to deltoid, 1–3 mm long; pedicels 3–4 mm long; bracteoles present on pedicels. *Calyx* 5–6 mm long, densely hairy, hairs appressed to patent, silvery to ferruginous; tube 2–3 mm long, shorter than or equal to lateral lobes; lobes attenuate to deltoid; vexillary lobes divided equally to lower three, free for c. 1.5 mm; lowest lobe 3–3.5 mm long, distinctly longer than lateral lobes. *Corolla* orange, green in centre, standard 7.5–11 mm long, claw 1.5–2 mm long, blade broadly ovate, slightly callused at base, apex emarginate; wings 6.5–10 mm long, longer than keel, blade obovate; keel 7–11 mm long, glabrous. *Staminal tube* glabrous near fenestrae, fenestrae callused on margins; upper filament \pm straight in lower half, callused near base, glabrous. *Ovules* 4–7. *Style* flattened, uniform, glabrous; stigma penicillate at base. *Fruit* a pod, linear to narrowly oblong, slightly upcurved near apex, compressed and raised over seeds, 33–45 mm long, c. 6 mm wide, with loose, membranous tissue between seeds, stramineous, densely hairy, hairs ascending to patent, white to stramineous; beak in line with upper suture, straight. *Seeds* 4–7 per pod, 5.5–6 mm between centres, smooth, mottled, pale and dark brown, oblong to lenticular, flattened, 3–3.5 mm long; hilum central; aril annular, pale, c. 0.4 mm long. Fig. 4 (A–I).

Other Specimens Examined: WESTERN AUSTRALIA: Buccaneer Archipelago [precise locality withheld], 6 Sept. 1988, B.J. Carter 324 (PERTH); Buccaneer Archipelago [precise locality withheld], 1906, W.V. Fitzgerald (PERTH); Buccaneer Archipelago [precise locality withheld], 31 Mar. 1992 A.A. Mitchell 2227 (DNA, PERTH); Buccaneer Archipelago [precise locality withheld], 4 Sept. 1986, M. Smith 86.15 (PERTH).

NORTHERN TERRITORY: Keep River National Pk, [precise locality withheld], 20 May 1997, I.D. Cowie 7596 (DNA); Keep River National Pk, [precise locality withheld], 31 May 1998, I.D. Cowie 7718 (DNA).

Distribution. Occurs sporadically from near Derby, W.A. to Keep River National Pk in the western N.T. Fig. 2C.

Habitat. The species grows in shrubland in sandy, often shallow soil amongst sandstone outcrops.

Flowering and fruiting. Flowers Apr. to Sept.; fruits Mar. to Nov.

Conservation status. Conservation Code for Western Australian Flora: Priority Three. The species is so far known from four widely spaced localities. It is conserved at Keep River National Pk in the NT where there is a population of less than 50 plants, although that Park has not been thoroughly surveyed and further populations may well exist there. The size of other populations is not known. Young plants observed at Keep River National Pk occurred in a relatively fire protected pocket and did not flower until at least their third year. A fire-free interval of more than this period would thus appear necessary for the long term maintenance of populations and fire frequency may act to restrict the abundance of the species.

Etymology. The epithet is from the Latin *valleculatus* meaning furrowed and refers to the distinctly furrowed young branchlets.

Affinities. *Tephrosia valleculata* is closely related to *T. lasiochlaena* (with which it has been confused because of the similar indumentum and leaflets) but *T. valleculata* has a 4–7-ovulate ovary, slightly curved 4–7 seeded pod with straight marginal beak, and axillary fascicles in only the upper few axils. *Tephrosia valleculata* is also closely related to *T. andrewii* but the former has a more erect growth habit, more ferruginous indumentum, narrower leaflets and pods with a straight marginal beak. Although having some resemblance to *T. carriemichelliae*, *T. valleculata* differs in growth habit, in the more ferruginous indumentum, in the 1- or 3- (rarely 5) foliolate leaves with narrower leaflets; in the vexillary calyx lobes divided to the same depth as the lower three; in the flattened, uniform, glabrous style with penicillate stigma; in the narrower, slightly curved pods and in the smaller seeds with a pale annular aril.

Collections from juvenile plants at Keep River National Pk, NT had 5-foliolate leaves with relatively large leaflets as compared to the more typical 1 or 3-foliolate leaves with smaller leaflets found on fertile collections from this and all other populations.

Lectotypifications

Tephrosia flammea F. Muell. ex Benth. *Fl. Austral.* 2: 207 (1864). - *Cracca flammea* (Benth.) Kuntze *Revis. Gen. Pl.* 1: 175 (1891). *Typus*: upper Victoria River, [N.T.], 1855–56, F. Mueller (*lecto* (here chosen): K!; *isolecto*: MEL!).

Bentham cites the specimens “York Sound, A. Cunningham” and “upper Victoria River, F. Mueller”. Also at K is an additional specimen of Mueller’s labelled simply “Victoria River” which was also most likely seen by Bentham. The upper Victoria River specimen is the most complete of the three, is clearly cited and fits the protologue. An R. Brown collection from “Island h” [North Island, N.T.] (dup at BRI) determined as *T. flammea* is not cited by Bentham.

Tephrosia nematophylla F. Muell. *Frag.* 9: 63 (1875). - *Cracca nematophylla* (F. Muell.) Kuntze *Revis. Gen. Pl.* 1: 175 (1891). *Typus*: Port Darwin, F. Schultz 431 (*lecto* (here chosen): MEL!; *isolecto*: K!).

Mueller cites two specimens - Schultz 304 & 431. Of these Schultz 431 is more complete and clearly fits the protologue.

Tephrosia oblongata R. Br. ex Benth. *Fl. Austral.* 2: 205 (1864). - *Cracca oblongata* (Benth.) Kuntze *Revis. Gen. Pl.* 1: 175 (1891). *Typus*: Groote Eylandt, [N.T.], 5–17 Jan. 1803, R. Brown (*lecto* (here chosen): K!, sheet with labels at bottom, one in Brown's writing "*Galega oblongata*, Groote Eylandt" *isolecto*: BRI!, K!, sheet with J.J. Bennett label no. 4129 in top LH corner, E, photo seen, MEL!, 2 sheets).

Bentham cites material as "Islands of the Gulf of Carpentaria, R. Brown" and afterwards adds the comment "A very imperfect specimen of A. Cunningham's from the N coast [Croker Island, NT], may belong to the same species,...". The sheet at K with Brown's hand written label "*Galega oblongata*, Groote Eylandt" is the most complete and clearly fits the protologue. An additional sheet at K with the J.J. Bennett label no. 4129 and sheets at BRI, E and MEL are regarded as part of the same collection.

Tephrosia polyzyga F. Muell. ex Benth. *Fl. Austral.* 2: 206 (1864). - *Cracca polyzyga* (Benth.) Kuntze *Revis. Gen. Pl.* 1: 175 (1891). *Typus*: Arnhem South Bay, point U1 [Mt. Caledon, Caledon Bay, N.T.], 6 Feb. 1803, R. Brown (J.J. Bennett Dist. No. 4127) (*lecto* (here chosen): BM, photo seen; *isolecto*: BRI!, MEL!).

Bentham cites the material "Upper Victoria River, F. Mueller" and "islands of the Gulf of Carpentaria, R. Brown". The Mueller specimen (labeled "Upper Vic R, Jan 1856") appears to consist of just one incomplete specimen with 4 leaves and some buds. As Mueller himself notes on the label "This was the only one found, and this piece was the only branch in flower". Although none of Brown's material was located at K, his collection is more complete, fits and has clearly been used in preparation of the description.

Tephrosia porrecta R. Br. ex Benth. *Fl. Austral.* 2: 206 (1864). - *Cracca porrecta* (R. Br. ex Benth.) Kuntze *Revis. Gen. Pl.* 1: 175 (1891). *Typus*: Islands, North Coast [Morgan Island, N.T.], 20–21 Jan. 1803, R. Brown (*lecto* (here chosen): K!; *isolecto*: BRI!, MEL! 2 sheets).

The material cited by Bentham constitutes collections by R. Brown and J. Armstrong, the latter consisting of a single sheet. The Brown specimen is more complete, fits the description and is chosen as lectotype.

Tephrosia reticulata R. Br. ex Benth. *Fl. Austral.* 2: 205 (1864). - *Cracca reticulata* (Benth.) Kuntze *Revis. Gen. Pl.* 1: 175 (1891). *Typus*: Carpentaria, Point S [Point Blane, N.T.], 28 Jan. 1803, R. Brown (*lecto* (here chosen): K!, sheet with J.J. Bennett label no. 4133 in bottom right hand corner; *isolecto*: BM, photo seen).

Of the syntypes listed by Bentham, Brown's collection from Point Blane best fits the original description, is more complete than the Islands [Morgan Island] collection and best preserves current usage. An additional sheet of the Point Blane collection is located at BM as are two other collections cited by Bentham. Of the latter, the Banks and Solander specimen (2 sheets) from Endeavour River [Qld] represents *T. varians* (F.M. Bailey) C.T. White, while the Cunningham specimen from Simms Island [N.T.] probably represents a third species (perhaps *T. gyropoda* Cowie).

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